

TOSHIBA Photocoupler GaAs IRed & Photo-Transistor

# TLP631, TLP632

Programmable Controllers

AC / DC-Input Module

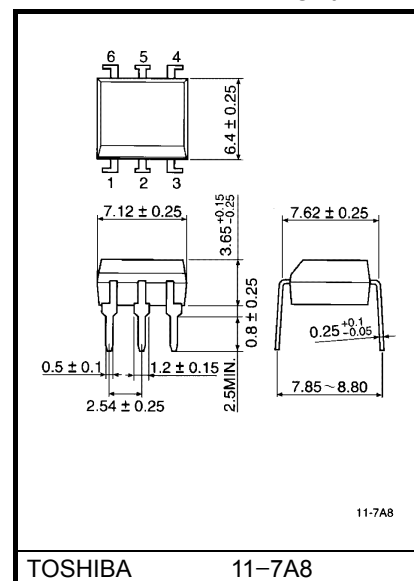
Solid State Relay

The TOSHIBA TLP631 and TLP632 consist of a photo-transistor optically coupled to a gallium arsenide infrared emitting diode in a six lead plastic DIP.

TLP632 is no-base internal connection for high-EMI environments.

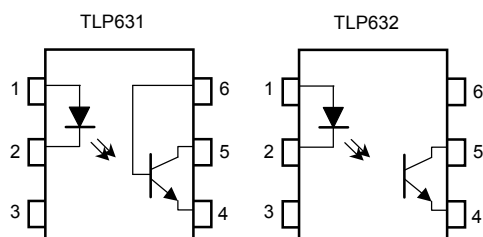
- Collector-emitter voltage: 55 V (min.)
- Current transfer ratio: 50% (min.)  
Rank GB: 100% (min.)
- Isolation voltage: 5000V<sub>rms</sub> (min.)
- UL recognized: UL1577, file no. E67349

Unit in mm



Weight: 0.4 g

## Pin Configurations (top view)



1: Anode  
2: Cathode  
3: N.C.  
4: Emitter  
5: Collector  
6: Base

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## Absolute Maximum Ratings (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
LED	Forward current	$I_F$	60	mA
	Forward current derating (Ta ≥ 39°C)	$\Delta I_F / ^\circ\text{C}$	-0.7	mA / °C
	Peak forward current (100µs pulse, 100pps)	$I_{FP}$	1	A
	Reverse voltage	$V_R$	5	V
	Junction temperature	$T_j$	125	°C
Detector	Collector-emitter voltage	$V_{CEO}$	55	V
	Collector-base voltage (TLP631)	$V_{CBO}$	80	V
	Emitter-collector voltage	$V_{ECO}$	7	V
	Emitter-base voltage (TLP631)	$V_{EBO}$	7	V
	Collector current	$I_C$	50	mA
	Power dissipation	$P_C$	150	mW
	Power dissipation derating (Ta ≥ 25°C)	$\Delta P_C / ^\circ\text{C}$	-1.5	mW / °C
	Junction temperature	$T_j$	125	°C
Storage temperature range		$T_{stg}$	-55~125	°C
Operating temperature range		$T_{opr}$	-55~100	°C
Lead soldering temperature (10s)		$T_{sol}$	260	°C
Total package power dissipation		$P_T$	250	mW
Total package power dissipation derating (Ta ≥ 25°C)		$\Delta P_T / ^\circ\text{C}$	-2.5	mW / °C
Isolation voltage (AC, 1 min., R.H. ≤ 60%)		$BV_S$	5000	V <sub>rms</sub>

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

## Recommended Operating Conditions

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	$V_{CC}$	—	5	24	V
Forward current	$I_F$	—	16	25	mA
Collector current	$I_C$	—	1	10	mA
Operating temperature	$T_{opr}$	-25	—	85	°C

Note: Recommended operating conditions are given as a design guideline to obtain expected performance of the device. Additionally, each item is an independent guideline respectively. In developing designs using this product, please confirm specified characteristics shown in this document.

**Individual Electrical Characteristics (Ta = 25°C)**

Characteristic		Symbol	Test Condition	Min.	Typ.	Max.	Unit
LED	Forward voltage	$V_F$	$I_F = 10 \text{ mA}$	1.0	1.15	1.3	V
	Reverse current	$I_R$	$V_R = 5 \text{ V}$	—	—	10	$\mu\text{A}$
	Capacitance	$C_T$	$V = 0, f = 1 \text{ MHz}$	—	30	—	pF
Detector	Collector-emitter breakdown voltage	$V_{(BR) \text{ CEO}}$	$I_C = 0.5 \text{ mA}$	55	—	—	V
	Emitter-collector breakdown voltage	$V_{(BR) \text{ ECO}}$	$I_E = 0.1 \text{ mA}$	7	—	—	V
	Collector-base breakdown voltage (TLP631)	$V_{(BR) \text{ CBO}}$	$I_C = 0.1 \text{ mA}$	80	—	—	V
	Emitter-base breakdown voltage (TLP631)	$V_{(BR) \text{ EBO}}$	$I_E = 0.1 \text{ mA}$	7	—	—	V
	Collector dark current	$I_{\text{CEO}}$	$V_{\text{CE}} = 24 \text{ V}$	—	10	100	nA
			$V_{\text{CE}} = 24 \text{ V}, T_a = 85^\circ\text{C}$	—	2	50	$\mu\text{A}$
	Capacitance collector to emitter	$C_{\text{CE}}$	$V = 0, f = 1 \text{ MHz}$	—	10	—	pF

**Coupled Electrical Characteristics (Ta = 25°C)**

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Current transfer ratio	$I_C / I_F$	$I_F = 5 \text{ mA}, V_{\text{CE}} = 5 \text{ V}$ Rank GB	50	—	600	%
			100	—	600	
Saturated CTR	$I_C / I_F (\text{sat})$	$I_F = 1 \text{ mA}, V_{\text{CE}} = 0.4 \text{ V}$ Rank GB	—	60	—	%
			30	—	—	
Collector-emitter saturation voltage	$V_{\text{CE}} (\text{sat})$	$I_C = 2.4 \text{ mA}, I_F = 8 \text{ mA}$	—	—	0.4	V

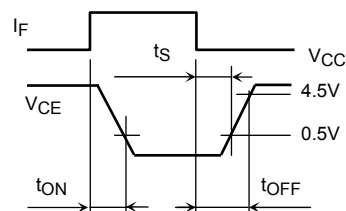
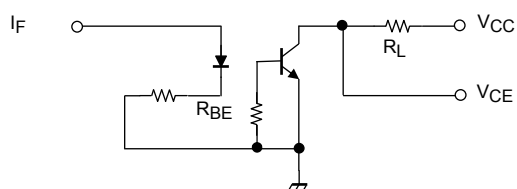
## Isolation Characteristics (Ta = 25°C)

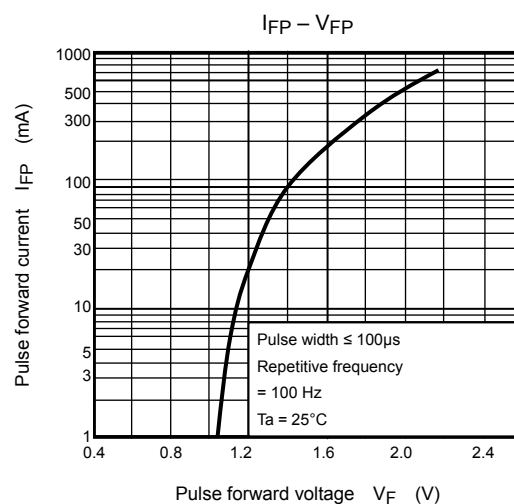
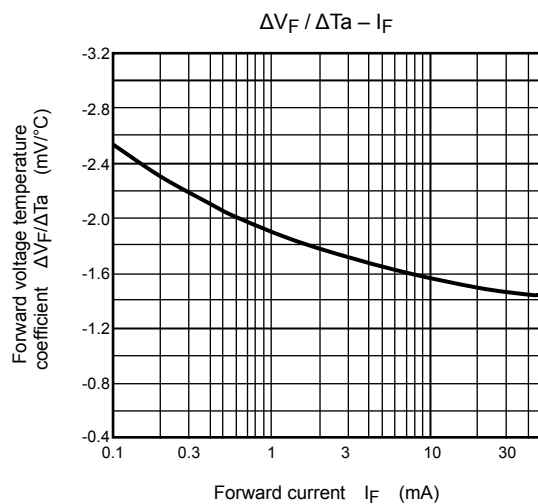
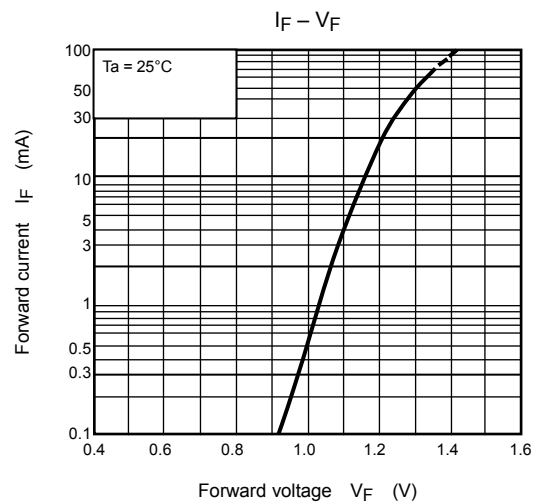
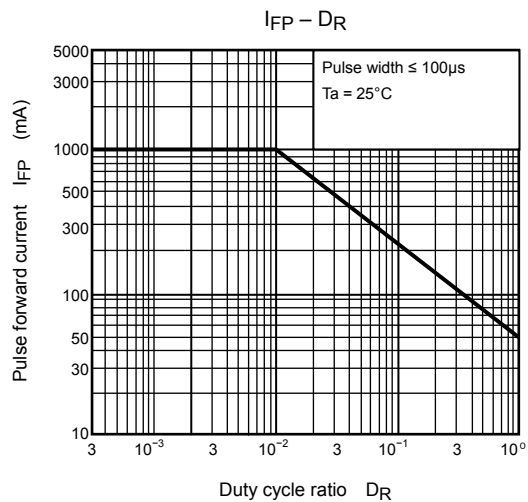
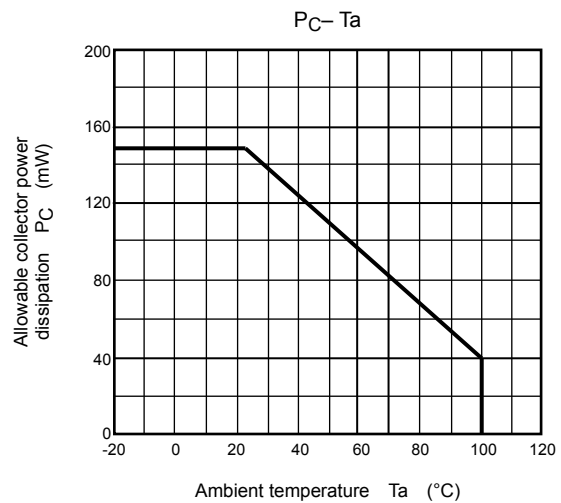
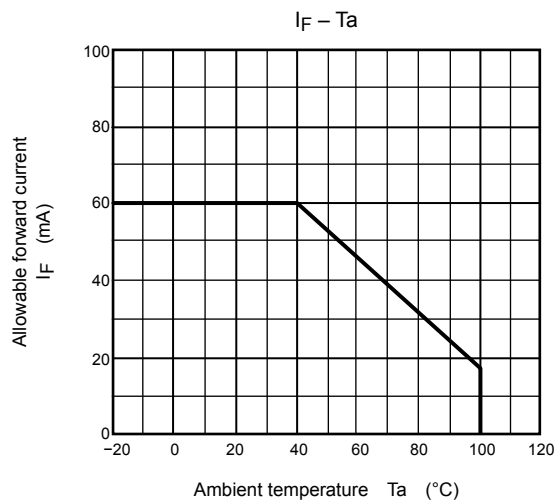
Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Capacitance (input to output)	$C_S$	$V_S = 0, f = 1 \text{ MHz}$	—	0.8	—	pF
Isolation resistance	$R_S$	$V_S = 500 \text{ V}, \text{R.H.} \leq 60\%$	$5 \times 10^{10}$	$10^{14}$	—	$\Omega$
Isolation voltage	$BV_S$	AC, 1 minute	5000	—	—	$V_{\text{rms}}$
		AC, 1 second, in oil	—	10000	—	
		DC, 1 minute, in oil	—	10000	—	$V_{\text{dc}}$

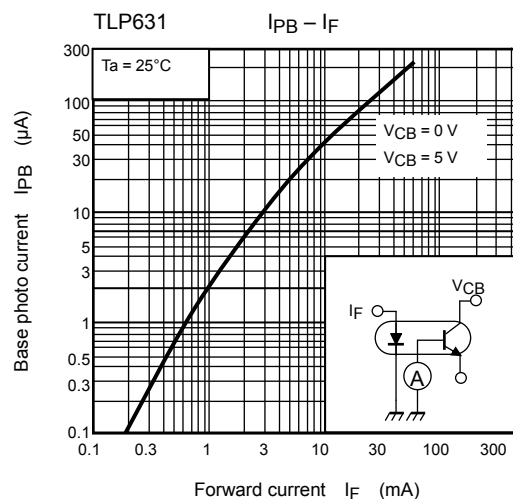
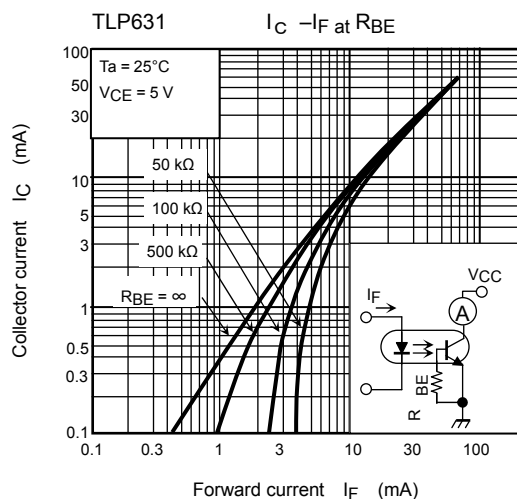
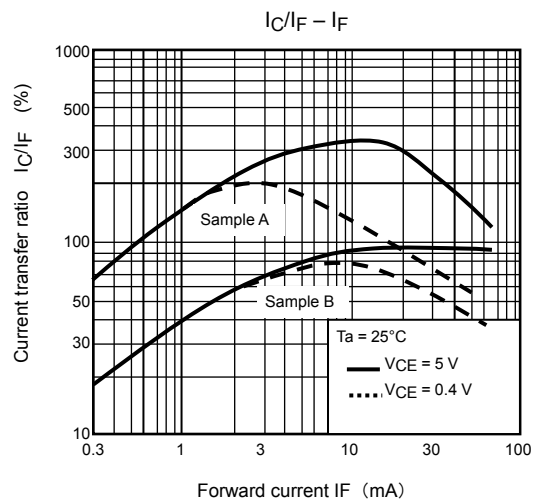
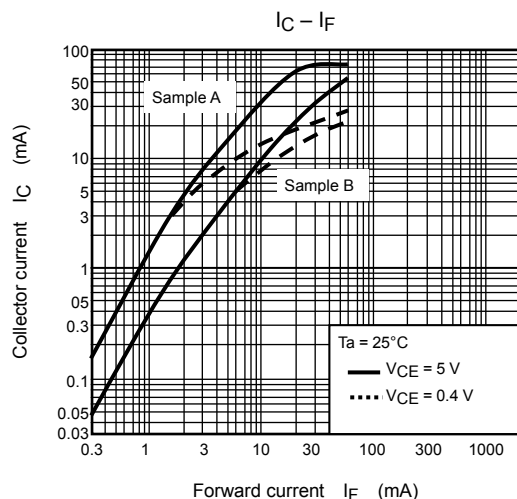
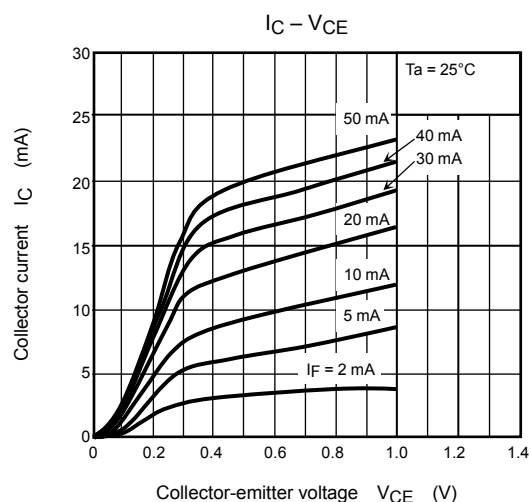
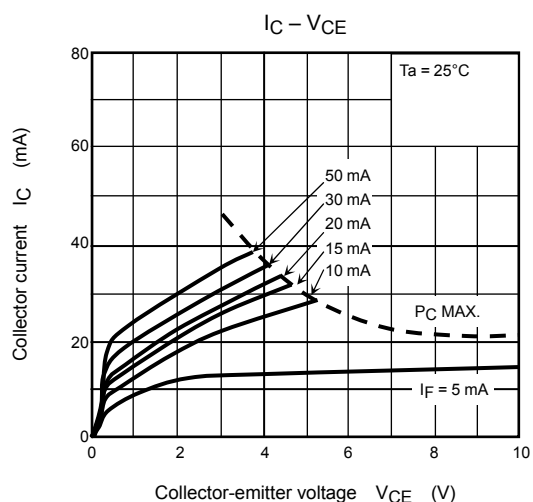
## Switching Characteristics (Ta = 25°C)

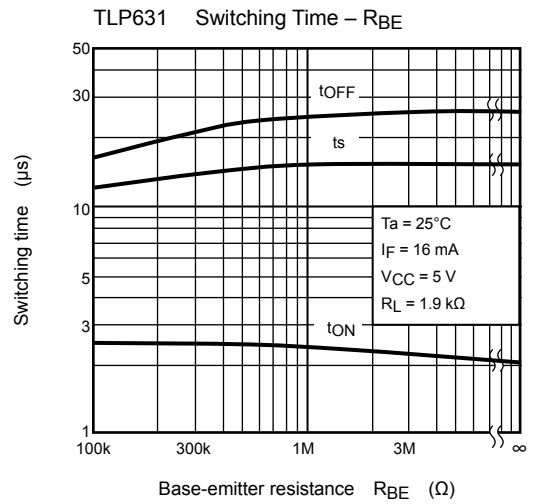
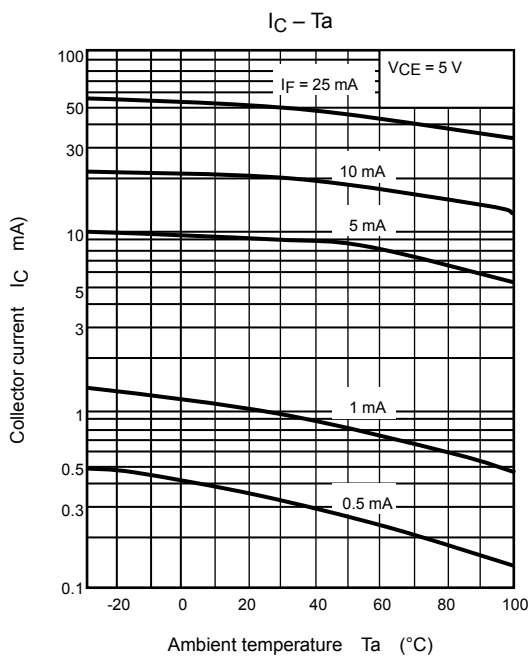
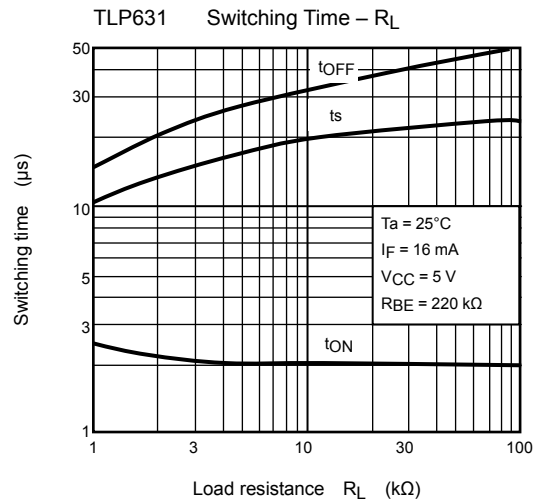
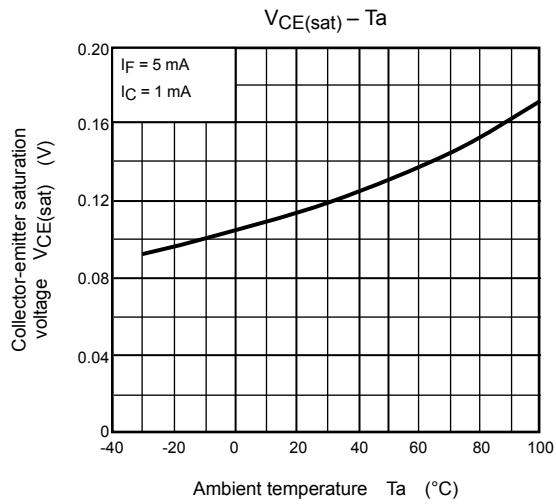
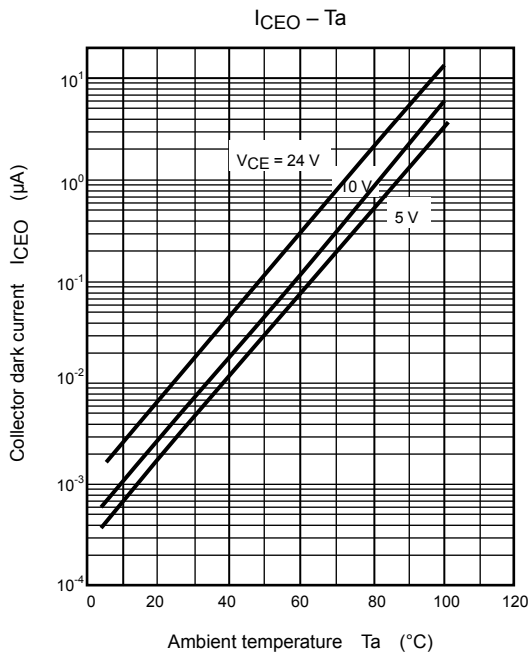
Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Rise time	$t_r$	$V_{CC} = 10 \text{ V}, I_C = 2 \text{ mA}$ $R_L = 100 \Omega$	—	2	—	$\mu\text{s}$
Fall time	$t_f$		—	3	—	
Turn-on time	$t_{\text{on}}$		—	3	—	
Turn-off time	$t_{\text{off}}$		—	3	—	
Turn-on time	$t_{\text{ON}}$	$R_L = 1.9 \text{ k}\Omega$ (Fig.1) $R_{BE} = \text{OPEN}$ $V_{CC} = 5 \text{ V}, I_F = 16 \text{ mA}$	—	2	—	$\mu\text{s}$
Storage time	$t_s$		—	15	—	
Turn-off time	$t_{\text{OFF}}$		—	25	—	
Turn-on time	$t_{\text{ON}}$	$R_L = 1.9 \text{ k}\Omega$ (Fig.1) $R_{BE} = 220 \text{ k}\Omega$ (TLP631) $V_{CC} = 5 \text{ V}, I_F = 16 \text{ mA}$	—	2	—	$\mu\text{s}$
Storage time	$t_s$		—	12	—	
Turn-off time	$t_{\text{OFF}}$		—	20	—	

Fig. 1 Switching time test circuit









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